

## MOST ABUNDANCE DIATOM TAXA OF RIVERS IN TURKEY AND IRAN

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### ABSTRACT

*The study of diatoms is necessary because they are the sources of oxygen in rivers, and also constitute the basic primary productivity chain and are used in determining water pollution levels. However, in this study some large rivers of Turkey and Iran were compared in this respect and it was thought that the spread of diatom species would contribute to Turkey and Iran diatom species. In the rivers, a lot of diatoms which are known as pollution indicator only *Achnanthes lanceolata* (Brébisson ex Kützinger) Grunow, *Caloneis ventricosa* (Ehrenberg) F. Meister, *Cyclotella meneghiniana* Kützinger, *Diatoma elongatum* (Lyngbye) C. Agardh, *Gomphonema olivaceum* (Hornemann) Brébisson, *Nitzschia sigmaidea* (Nitzsch) W. Smith, *Pinnularia brebissonii* (Kützinger) Rabenhorst, *Rhoicosphenia curvata* (Kützinger) Grunow, *Nitzschia palea* (Kütz.) W. Sm., *Ulnaria acus* (Kütz.) M. Aboal, *Ulnaria ulna* (Nitzsch) Compère and *Gomphonema truncatum* Ehrenberg in the Turkey and Iran rivers. The aim of this study is, to assess the diatom of Iranian rivers and evaluate as abundance relation to Turkey rivers.*

**KEYWORDS:** Abundant, Diatoms, Rivers, Turkey & Iran

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### INTRODUCTION

Turkey is drained by 107 major rivers, each with a catchment larger than 1 500 km<sup>2</sup>. Kızılırmak is the longest river (1355 km), followed by the Euphrates (Fırat; 1263 km in Turkey), Tigris (Dicle; 523 km in Turkey), Seyhan (560 km), Aras (548 km in Turkey), Yeşilırmak (519 km), Ceyhan (509 km), Coruh (442 km in Turkey), Gediz (400 km), Susurluk (321 km), Greater Meander (307 km) and Smaller Meander (174 km). Of these, the Euphrates, Tigris, Meriç, Çoruh, Aras, and Asi are Transboundary Rivers.

Most Iranian rivers are seasonal in flow, relatively short in length, and shallow in depth. Of Iran's major rivers, five flow into the Persian Gulf, these being the Dez (401 km), Karkheh (902 km), Karoon (945 km), Diyala (445 km), and Lower Zab Rivers (400 km). Four, the Aras (450 km in Iran), Sefid Rud (666 km), and Atrek Rivers (666 km), Jajrood River (140 km) flow into the Caspian Sea. Two others flow into smaller inland basins, namely the Zayandeh (400 km) and Aji Chay (265 km).

The study of diatoms is necessary because, they are the sources of oxygen in rivers, and also constitute the basic primary productivity chain and are used in determining water pollution levels. However, this study will contribute to the diatom flora of Turkey. The benefit of freshwater as an environmental resource, which can be used to the potential benefit for humanity and environment, cannot be over emphasized because, the diversity of fresh water diatoms is enormous. Although, algae constitute a fundamental part of the aquatic food chains, only few research papers deal with the freshwater or marine diatoms of Iranian environment. Some authors have studied the seasonal distribution of phytoplankton (Moghadam, 1976) in Iran. In Turkey most diatom species detected in

Nilüfer Stream (Dere, et. al., 2002), Sakarya River (Atıcı & Yıldız, 1996), İncesu Creek (Gönülol & Aslan 1992) river Yeşilirmak (Pabuçcu & Altuner 1999, Soylu & Gönülol 2003), Kızılırmak (Dere & Sıvacı, 1995, Yıldız & Özkıran, 1991) river Asi (Şen et. al., 1997) and Çoruh River (Atıcı & Obalı, 1999-2000). Diatoms were used as an indicator of pollution in a small section of the Zayandeh River in Isfahan, Iran by Moghadam (1976) Haraz River (Khosravi-Rineh, 2010) and Afsharzadeh et al., 2003. In recent years, Soltanpour-Gargari et al., (2011) reported 155 diatom taxa from Ramsar in the north west Iran.

Jamalo et al., (2006) stated that, 51 species were reported on Epilithon Diatoms of Jajrood River, respectively. Also, some studies, on the diatoms communities in Mesopotamia were conducted by Hirano, (1973) in Hormozgan Province and in the river Hevigh, Gulian Province. The diatoms of the coastal area of the Caspian Sea (Nasrollah et al., 2012), with hundreds of large and small tributaries have received little attention; though diatoms, especially the fresh water species, are the major group of algae. The aim of this study is, to assess the diatom flora of Iranian fresh water ecosystems and evaluate the relation to Turkey Rivers. Moghadam (1976) and Afsharzadeh et al., (2003), observed a total of 38 and 113 species, respectively from the Zayandeh Rood River in central Iran. The following taxa were also found in the Tajen River (Masoudian et al., 2009): *Amphora ovalis*, *Cocconeis pediculus*, *Cyclotella meneghiniana*, *Cymbella helvetica*, *Diatoma vulgare morphotype vulgare*, *Nitzschia palea*, *Nitzschia sigmaidea*.

Generally, on the sediments of the rivers, there is *Diatoma hiemale* var. *mesodon*, *Ceratoneis arcus*, *Fragilaria capucina*, *Ulnaria ulna*, *Gyrosigma acuminatum*, *Navicula lanceolata*, *Gomphonema parvulum*, *Hantzschia amphioxys*, *Nitzschia linearis* and *N. hungarica* species were discovered in large numbers and were widespread. Among these, *Ulnaria ulna* and *Nitzschia hungarica* species, on the sediments of the stream Ankara and some others on the sediments of the river Sakarya, river Çoruh and the stream Porsuk, were widespread and also were detected in large numbers. On the sediments of Aras (part of Turkey and Part of Iran), apart from *Nitzschia linearis*, all the other species were detected. In addition, these species of *Diatoma elongatum*, *Meridion circulare*, *Ulnaria capitata*, *Navicularia diosa*, *Pinnularia mesolepta*, *Cymbella affinis*, *C. lanceolata*, *Gomphonema subclavatum* and *Nitzschia dubia* existed on various kinds of plants and rocks, in the river Çoruh and the others are seen in the large numbers, on the various kinds of plants and rocks in the river Sakarya. In the river Aras, except for the species of *Cymbella lanceolata*, *Denticula elegans*, *Nitzschia dubia* and *Gomphonema subclavatum* the others are seen on the various kinds of plants and rocks. In addition, in the river Ankara, similar circumstances were present.

All of the arms of the river, which feed that river, are convenient habitats for trout niche. Therefore, in the river water of studied region, any industrial pollution and home pollution were not observed. In the rivers, a lot of diatoms, which are known as pollution indicators, only *Achnanthes lanceolata*, *Caloneis ventricosa*, *Cyclotella meneghiniana*, *Diatoma elongatum*, *Gomphonema olivaceum*, *Nitzschia sigmaidea*, *Pinnularia brebissoni*, *Rhoicosphenia curvata* and *Ulnaria ulna* were found, in less numbers in the Turkey Rivers.

Numerous phycological investigations have been performed in the different Turkish river and lake basins, and Ehrenberg already published the first study on diatoms in 1845. Subsequent work has concentrated mainly on diatoms, in the phytoplankton, while riverine systems have received less attention. The aim of this study is, to reveal the characteristics of diatom communities, between Iran and Turkish rivers.

## MATERIALS AND METHODS

A list of taxa reported in these publications was compiled in a table, denoting whether the dominant taxa occurred in rivers. Tables and figures were produced using Microsoft® Word and Excel 2013.

## RESULTS AND CONCLUSIONS

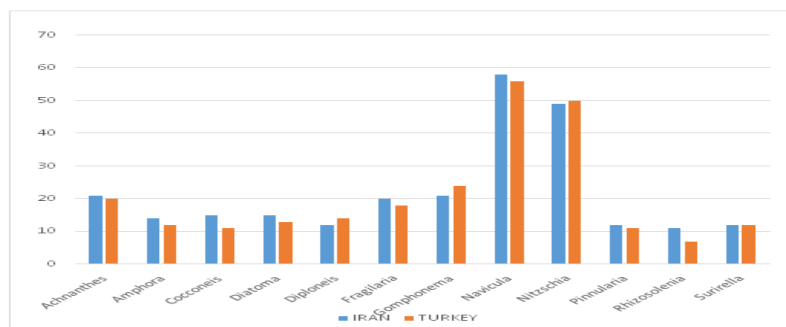
Of the identified taxa in this study, *Achnanthes*, *Amphora*, *Caloneis*, *Cocconeis*, *Cyclotella*, *Cymatopleura*, *Cymbella*, *Diatoma*, *Diploneis*, *Fragilaria*, *Gomphonema*, *Navicula*, *Nitzschia*, *Pinnularia*, *Rhizosolenia* and *Surirella* were recorded at the most sampling sites in Iran. Seven diatom species as *Amphora commutata*, *Cymbella affinis*, *Haslea spicula*, *Navicula paramutica*, *Navicula pygmaea*, *Nitzschia scalpelliformis* and *Stauroneis anceps* var. *Anceps* were reported by Wasylik (1975), from different areas of Iran.

The diatom of the river Çoruh (Atıcı&Obalı, 1999-2000) of the river Sakarya (Atıcı&Yıldız, 1996), of the river Aras (Altuner, 1988) of the river Kızılırmak (Yıldız&Özkıran, 1994), of the river Karasu (Altuner&Gürbüz, 1988-1989-1990-1991), of the stream Samsun İncesu (Gönülol&Aslan 1992) and of the stream Ankara (Yıldız&Atıcı, 1996), is similar to diatom distribution of Zayandeh Rood river (Afsharzadeh et al., 2003) and of the Bahmanshir River (Faal, 2005), in Iran.

Diatoms, which live together with Epipelagic, Epiphytic, and Epilithic habitats, are blend plankton in the rivers. Similar findings were able to be observed in the previous researches (Fatemi et. al., 2005), (Gönülol et. al., 1992), Masoleh-Roodkhan River (Sharifinia et. al., 2012), between two country.

Although, the centric diatoms such as *Cyclotellameneghiniana* and *C. ocellata* were found in large number in the rivers Sakarya, Kızılırmak, and the stream Ankara, these types were found in a few numbers in the river Çoruh, as they were found in the stream Porsuk (Yıldız, 1987) and Karasu (Gürbüz&Ertuğrul, 2003). The *C. kützingiana* and *Melosiragranulata* found in few numbers in the river Sakarya and the stream Ankara, were also found in few numbers in the river Çoruh. Among Pennatdiatoms, there are *Diatomeelongatum*, *D. vulgare*, *Fragilaria intermedia*, *Ulnariaacus*, *Didymosphaeniageminata*, *Naviculagastrium*, *N. pupula*, *P. divergens*, *Nitzschiasigmoidea* and *Surirella ovata* var. *Pinnata* species were found in large numbers, in the river Sakarya and the stream Ankara, stream Akçay (Solak et al., 2007) Stream and they were found in large numbers, in the phytoplanktons of the river Çoruh as well.

Moghadam (1976) and Afsharzadeh et al., (2003) observed a total of 113 species, respectively from the Zayandeh Rood River in central Iran. Karoon and Dez Rivers (in southern parts) Jaferzadeh et. al., (2004), reported 43 taxa from 21 localities in the central and southeastern parts of Iran. The following taxa were also found in the present study: *Amphora ovalis*, *Cocconeis pediculus*, *Cyclotellameneghiniana*, *Cymbella helvetica*, *Diatoma vulgare*, *Nitzschia palea*, *Nitzschiasigmoidea*, which are similar to Masoudian et al., (2009) results. Furthermore, Moghadam (1976) from Zayandeh River and Gargar Rivers Rasti et al., (2008) were reported 16 taxa, as *Amphora ovalis*, *Cyclotellameneghiniana*, *Cymatopleura elliptica* var. *elliptica*, *Diatoma vulgare*, *Fragilaria ulna* var. *ulna*, *Gomphonema parvulum*, *Gyrosigma scalproides*, *Navicula bacillum*, *Navicula cryptocephala*, *Navicula viridula* var. *viridula*, *Nitzschia palea*, *Nitzschia sigmoidea*, *Nitzschia ericularis*, *Rhoicosphenia abbreviata*, *Stauroneis anceps* var. *anceps*. In the following list of diatom taxa number compared Iran and Turkey, the systematic classification has been followed, as far as possible (Figure 1).



**Figure 1: Some Dominant Diatoms Tax a Number Comparison between Iran and Turkey**

In regard to this study, centric diatoms have the indicators of euotrophic and pennate diatoms indicator of fresh water. The identified taxa in Iranian river, *Amphora ovalis*, *Caloneisbacillum*, *Cocconeisplacentula*, *Cyclotellameneghiniana*, *Cymatopleurasolea*, *Cymbellahelvetica*, *Gomphonematruncatum*, *Naviculacryptocephala*, *Naviculasalinarum* and *Nitzschiapalea* were recorded at the most sampling sites. Seven diatom species *Amphora commutata*, *Cymbellaaffinis*, *Hasleaspicula*, *Naviculaparamutica*, *Naviculapygmaea*, *Nitzschiascalpelliformis* and *Stauroneis anceps* var. *anceps* were reported by Wasyluk (1975) from different areas of Iran. The following taxa were also found in the present study: *Amphora ovalis*, *Cocconeispediculus*, *Cyclotellameneghiniana*, *Cymbellahelvetica*, *Diatoma vulgaris morphotype vulgaris*, *Nitzschiapalea*, *Nitzschiasigmoidea*. Study some of Turkish rivers conducted epilithic algae; *Nitzschia dissipate*, *Naviculaexigua*, *Naviculacuspida*, *Cymbellacistula*, *Gomphonemaminutum*, *Gomphonemaolivaceum* and *Surirella* the most dominant species, identified as species. In an epipelagic algae; *Navicula*, *Nitzschia*, *Cymbella*, to *Surirella*, and *Pinnularia*, belonging to taxa have been reported to be intense. In a study conducted in the epilithic algae; *Nitzschia*, *Navicula*, *Cymbella* and *Gomphonema* were found to be the dominant genera. All Iranian and Turkish rivers are important confused habitat corridors.

Benthic diatom communities react very quickly to disturbances of the water (e.g. to changes in the physico chemical conditions of the water or to the pollution, affecting the catchment area), very often by changes of their species composition or diversity, which can vary from species rich to monotonous communities. Because, of this characteristic, benthic diatom communities are a useful tool, in detecting anthropogenic impacts. Research on diatom communities along river gradients, either at a local, regional or continental scale, has shown the prevalence of (1) down stream gradients (from fast-flowing oligotrophic high land rivers to eutrophic rivers of low-elevation plains), (2) chemical factors related to catchment geology, mostly alkalinity and pH, and (3) latitudinal and altitudinal variation of temperature.

Generally, Turkish river and Iran river basin, by anthropogenic effects unseen regions here because, *Cyclotellameneghiniana*, *Cymbellahelvetica*, *Synedra ulna* and *Spirulina subsalsa*, taxa have been determined both of them.

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